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East Europe Report

SCIENTIFIC AFFAIRS

No. 731

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CSSR INDUSTRIAL ROBOT PRODUCTION ADVANCES, CEMA COOPERATION

Bratislava SMENA in Slovak 28 Dec 81 p 3

[Article by Mirko Turcan: "Robots for Every Task"]

> [Text] "Technological and product innovation constitutes the main road to the reduction of demands for material and power. It requires a substantial increase in the effectiveness of the efforts of design, technical and technological departments. The Central Committee appeals to designers, design engineers and technologists, to eminent workers, inventors and innovators to join their powers, experience, knowledge and abilities in the implementation of measures which will bring about a higher evaluation of materials and energy, an accelerated technological process, better use of fixed assets, and an increase in the quality and economy of production." (From the resolution of the Fifth Plenum of the CPCZ Central Committee.)

It Is up to Us

Have you ever imagined a situation in which it is you who must decide how the production in some of the big industrial plants in our country will develop further, for instance, in engineering tasks? Put your hand on your heart. To criticize is easier than to propose a constructive solution....

Now imagine that there are several hazardous or dangerous work sites in our plant, that we are struggling with a shortage of workers, that the machines are used mostly during one shift only, that our products must be exceptionally precise and reliable, that we cannot extend the plant any more and, what is most important, that the plan bids us to increase production 6 percent every year. It is a real hard problem, however, it is necessary to say that the situation described above can be regarded as quite usual in our economic practice.

There is no magic wand or secret formula; technological innovation is the only actual prospective way out. More specifically, a situation seemingly unsolvable at first glance can be solved through timely introduction of progressive machine tools; under present conditions, these will be digitally controlled and, in our case, the need for innovation in hazardous, dangerous environments can be solved primarily by the introduction of robots. Robots are suitable for any type of work. Today, a proverb can be used literally in an innovated form--Where the devil cannot go himself, he sends a robot. Thanks to "Emil" from the realm of our childhood imagination, it is now possible to achieve a significant increase in labor productivity in modern industrial production, to improve accuracy and quality, to eliminate hard and monotonous work and, what is most important, to increase substantially the safety of work.

The automation of technological and manufacturing processes, with an emphasis on the development of industrial robots and manipulators, is a new direction developing with incredible speed all over the world. The area of application of such 20th century "miracles" expands, so to speak, geometrically. However, we can speak of complex automation only when, beside the automation of the technological process itself, we are also able to automate auxiliary manipulation operations related to it and manual technological operations. "Robotization," the introduction of robots, has its place everywhere in this area.

How Is It Here?

The solution of the problems of the automation of manufacturing processes through industrial robots and manipulators was emphasized at the 16th CPCZ Congress. The problems of automation found adequate space in the Main Directions of the Economic and Social Development of the CSSR for 1981-1985. The state goal-oriented program entitled Robots and Manipulators, whose coordinating project manager is the Federal Ministry of General Engineering, obliges industry to produce and apply in practice a minimum of 3,000 robots and manipulators. A proper portion.

These "obedient machines" will save 5,500 workers in our industry, particularly in the most hazardous places. For the next period, the program assigns an even more demanding task; 13,000 robots and manipulators are expected to be manufactured and introduced before 1990, which will save 30,000 workers. The center of gravity for the solution of this goal-oriented program is in Slovakia. In the first stage, before 1985, 2,000 robots worth Kcs 776 million are expected to be manufactured in Slovakia out of the total number of 3,000 robots worth Kcs 963.9 million. This represents a 56.6 [sic] percent portion of the number of pieces and a more than 80 percent portion in terms of cost. Together with the production of auxiliary equipment, the total cost for Czechoslovakia represents Kcs 1,174.9 million. More than 82 percent falls to Slovakia's share.

The basic research in the area of robotics will concentrate primarily in the Institute of Technical Cybernetics of the Slovak Academy of Sciences (SAV) and colleges. The goal project entitled Information and Control Systems of Robotics for the Seventh Five-Year Plan aims primarily at adaptive control of industrial robots and manipulators, the theoretical problems of robotics and artificial intelligence, computer systems and the control of intelligent robot systems. At present, the highest degree of concentration of scientific and research capacities is in the Institute of Technology in Kosice, where the Department of Automation and Robotechnology has been in existence since 1981, equipped with an appropriate laboratory for automation and robotization.

The SAV Institute of Technical Cybernetics is working on experimental manufacture of some realization outputs and, together with selected plants and research institutes it is securing the beginning of series manufacture and repeated manufacture on a contract basis.

Since this developing field has no industrial base of its own, the production volumes planned for the period of structural reconstructions are secured in a considerably improvised way; apart from the capital construction of new production capacities, this is by reconstruction and modernization of existing plant and the introduction of this program instead of the "runout" program. In Slovakia, the plant is situated in Vihorlat Snina, the Heavy Engineering Works (STS) Detva, ZTS Kosice, the Bratislava Automation Works in Bratislava, the Industrial Automation Works in Presov and the Metal-Working Industry Research Institute in Presov.

Emil From Presov

The above-mentioned Research Institute in Presov has the largest share in the development of robotation in our country. It seems that Emil the Robot feels at home in the Saris metropolis. No wonder, since it was right here where this new field received the best welcome and where the people have done most for its development. In May 1981, a creative team of research and development workers, designers and design engineers was awarded the Klement Gottwald State Prize for the development, design and construction of the PRaM type series.

With respect to its exceptional dynamics and interbranch character, the robotation development program requires flexible organization and management within the entire cycle: research, development, manufacture, application. VUKOV in Presov was commissioned to meet these needs as early as 1978.

The concept of this field's development is based on the fact that the CSSR has a well-developed machine industry, 70 percent of which is single-piece or small-series manufacture, where automation depends actually on flexibly programmable and readily rearrangeable manufacturing and manipulation equipment. Endeavoring to meet these needs as soon as possible, the people in Presov, working on the research stage, concentrate primarily on the coordination of basic and applied research and the coordination of international scientific and technical cooperation, primarily with the Soviet Union. In 1981, a branch testing laboratory for the evaluation of industrial robots and manipulators was opened here. As far as the manufacturing stage is concerned, they cooperate with future manufacturers and assemble testing series, atypical attachments and elements for building working centers, including application. Apart from work on the development and design of technological working centers using robots and manipulators, they secure service and organize training and courses for both designers and operators. Being a branch center, the newly established Institute of Automation Technology organizes programming, operation and maintenance courses for operators of individual types of industrial robots and manipulators. Also, they organize seminar training for manufacturers as well as other specialized courses, such as programming in the FORTRAN language, microprocessor application, calculator programming and the like.

What We Have Achieved so Far

During the Sixth Five-Year Plan, the PRaM module-based type series designed for the manipulation with parts of the mass of 1 to 160 kg was developed, using elements of mostly domestic origin and applying one of the most progressive design methods in the world--module assembly. Good experience with automated technological centers using industrial robots and manipulators can be confirmed by the workers of the Slovak National Uprisal (SNP) Works in Ziar nad Hronom, who use automated centers to cast aluminim; also by the workers in the ZTS Martin, who have good experience related to machining, the workers in the Machine Tools Factory in Trencin and 27 other automated technological centers using the VUKOV type series. Of the total of 12 automated technological centers opened in Slovakia, 4 have been designed for machining, 3 for experimental purposes, 2 for pressure casting, and 1 each for pressworking, forging, and checking, respectively. Provided the cooperation of industrial robots and manipulators with other means of production in terms of space and time is well coordinated, three hierarchic levels of flexible automation of technological processes can be formed. These levels are: automated technological centers, the automated technological line, and automated manufacturing operations.

Our Place in CEMA

Similar support to the development of industrial robotization and manipulation is given in the Bulgarian People's Republic and GDR. Exceptional attention has been paid to the development of this field in all socialist countries, particularly during the last 5 years, which has found an expression in the long-term, goal-oriented specialization program for the CEMA countries. This trend is regarded as very significant in the Soviet Union, where more than 100 various types of robots and manipulators have been developed and applied in several branches of industry. Resolutions concerning main directions in economic and social development adopted at the 26th CPSU Congress and special resolutions of the CPSU Central Committee concerning production increase and wide application of industrial robots throughout the entire national economy of the Soviet Union also demonstrate concentrated goal-oriented progress in the development of the robotization of industrial processes.

Simultaneously with the development of industrial robots and manipulators and robotization of industrial processes, CSSR participates actively in bilateral and multilateral agreements. The ultimate objective of the CEMA countries' multilateral international science and technology cooperation in the area of robots and manipulators development is to unite all efforts toward a coordinated development and preparation of a type series of industrial robots and manipulators uniform for all the CEMA countries. With this objective in mind, it is necessary to secure a more flexible development of the unit base, to unify the approach to intensive design exchange and mutual supplies in order to build automated working centers.

Cooperating with the ENIMS Institute in Moscow, NIISL in Odessa and ENIIKMAS in Voronez, the Research Institute of Metal-Working Industry in Presov is about to complete the development of the UM160 industrial robot designed for the automation of machine-tool operations, the AM5 programmable manipulator for the automation of technological centers for flat forming and the MTL 10 specific-purpose manipulator for metal-casting under pressure. At present, a long-term complex program for the development and introduction of industrial robots and manipulators is being prepared between the CSSR and the USSR.

Steps in the Future

Today, everybody understands the need for further accelerated development of robotization. In the CSSR, the main direction has been determined for the period 1981-1990. During the Seventh Five-Year Plan, we will be concerned primarily with completing the type series development, the development of the first representatives of adaptive robots, and the deepening of the unity with the CEMA countries. At the same time, we must successfully test robot group introduction in engineering technologies, develop repeated manufacture as well as the activity of the engineering-design departments assigned to the introduction of industrial robots and manipulators. After 1986, we will concentrate on the development of intellectural robots and manipulators and the development of their production based on specialization and cooperation with the CEMA countries. Industrial robots and manipulators are expected to be used mainly by the manufacturers of cars, tractors, construction, and road construction machinery and electrical engineering and consumer goods industries.

The automation-development program for manufacturing processes solves essentially the requirements for the reduction of manual work. At the same time, it eliminates heavy and hazardous work harmful to human health. Real data illustrate the improved situation best. One industrial robot or manipulator saves 1.6 to 2.5 workers. As a result of a reduction in other time factors, the full utilization of manufacturing machines will increase 20 percent. By securing the second or third shift, we will achieve an increase of up to 50 percent in machine use. This will be possible without any demands on an increase in the number of workers. We can save almost Kcs 1.5 billion through planned development of robotization and also by decreased demands for the export of industrial robots and manipulators during the period of the Seventh Five-Year Plan. These are facts which need no comment.

9814
CSO: 2402/13

CEMA WELDING EXPERIMENTS, COOPERATION DISCUSSED

Bratislava SLOBODA in Slovak No 37 10 Sep 81 p 6

[Interview with Eng Jan Skriniar, Candidate for Doctor of Science, by Pavol Skrina; date of interview in Bratislava not given]

> [Text] The CEMA Committee for Scientific-Technical Cooperation has organized, on an experimental basis, cooperation among the socialist countries throughout the entire cycle from research to production. In addition to the problem of "The Comprehensive Utilization of Wood Materials," the participating countries have also been working on the problem of "The Development of the Scientific Foundations and Formulation of New Technological Processes in Welding."
>
> The second of these problems was the reason that led us to the Welding Research Institute in Bratislava, and specifically to its director, Eng Jan Skriniar, Candidate for Doctor of Science, the man fully empowered by the CSSR Government to assure the fulfillment of agreements concerning scientific-technical cooperation in the field of welding.

[Question] Comrade director, could you acquaint us a little with the current situation in scientific-technical cooperation among the CEMA countries in the field of welding?

[Answer] Our Welding Research Institute is cooperating primarily with organizations in the Soviet Union, but also with those of other countries, within the framework of multilateral scientific-technical cooperation among the CEMA countries. An agreement concerning multilateral cooperation was signed in 1972 in relation to a problem, the precise name of which was--"The Development of Scientific and New Technological Processes for the Welding, Surfacing, and Cutting of Various Materials and Alloys for the Production of Welded Assemblies and the Preparation of Efficient Welding Materials and Equipment." The basis of this experiment is to conduct on an international scale, cooperative research and development as far as the implementation phase.

The thematic areas in which this cooperation is being realized are widespread. At present, 23 problems are being worked on through this format of multilateral cooperation. The Soviet Union, Bulgaria, Hungary, the GDR, Poland, Romania, Yugoslavia, and Czechoslovakia are participating in the solution of these problems. The Soviet Union is cooperating on solutions to all the problems, while Czechoslovakia is working on 17 of them, and the Welding Research Institute on 15 of these. In addition to ourselves, other participants include, for instance, the Nove Mesto nad Vahom Mechanization and Automation Research Institute, the Presov Metallurgical Research Institute (VUKOV), Vrable Tesla, and Olomouc Sigma. Our most traditional Soviet partner is the Patonov Electric Welding Institute in Kiev, which is the coordinating center for the solution of this problem. Moreover, one may cite the Moscow Bauman Technical Institute, the Leningrad Scientific Research, Design-Fabrication, and Technical Institute for Electrical Welding Equipment, etc.

[Question] Are there already several concrete results from this experiment in international cooperation?

[Answer] The first attempt was the cooperative development of the semiautomatic INTERMIGMAG for welding in a shielding atmosphere of carbon dioxide. This problem was solved by the USSR, CSSR, Bulgaria, and the GDR. As a state testing center, we evaluated individual developed components and the whole semiautomatic machine, which was then "finalized" in the USSR. At the conclusion of this cooperative development, 100 of these semiautomatic machines were produced cooperatively, and they are for the most part being tested by the participating countries.

This was actually the first test of whether it is possible to develop complex welding equipment through a cooperative, coordinated effort, so that each of the CEMA countries does not have to develop and produce, of its own accord, automatic and semiautomatic welding machines.

[Question] What other examples are there of integrational trends within your field?

[Answer] As an example of an integrational trend it is possible to cite the first cooperative development of an industrial robot (that is, a robotized welding station) for arc welding. This work station consists of a Bulgarian orthogonal manipulator of a welding torch, welding equipment with a control system based on Soviet microprocessors, and the manipulator which is being controlled. A second variant of this work station will already have a robot from the CSSR with multiangular kinetics.

At the conclusion of the first stage of this project (following the completion of tests of the functional models of robotized work stations in 1982), a recommendation for the specialization of production and for deliveries of the developed work stations and their components within the framework of the CEMA countries is to be formulated. In the future, it is possible to assume that cooperation will also be utilized in other projects, above all in the area of more advanced methods of adaptive control and layouts of systems for robots.

On the basis of the experiences resulting from the resolution of these and other problems, one may state that along with broad, multilateral cooperation it is wise also to maintain fruitful bilateral cooperation, especially with traditional partners.

[Question] How does this bilateral cooperation affect your institute and other organizations in the SSR?

[Answer] For the 1981-1985 period, several bilateral agreements have been signed. Thus, for example, an agreement exists between our Welding Research Institute and the Patonov Institute in the area of the development of automatic process control for resistance-welding machines on the basis of microprocessors. It is a matter of controlling spot welding and inspecting the quality of welds during the welding process, which will make possible a reduction by as much as one-half in the need for welds in, for instance, the production of automobile bodies! We have already developed the equipment, and produced it in the Bratislava Electrical Engineering Factories. At present it is operational in Poland. The Soviets, again, solved the problem of the group application of this type of welding machinery in the production process.

During this period, we will also be working with the Patonov Institute and with the Research Institute for the Rationalization of Bearing Production in Zilina on the use of electron-beam welding for the welding of bearing cages.

In addition, we have an agreement with a research institute in Timisoara in the area of the development of PLAZMAMIG equipment, which will represent the merging of two welding techniques in a single piece of equipment, namely plasma welding and welding in a shielding atmosphere of inert gas. This results in a substantial speeding up of the relatively slow process of welding in an atmosphere of inert gas. So far, similar equipment has not been produced in the CEMA countries. Or, one may cite our agreement with Energoinvest of Sarajevo in the area of new techniques for testing welded joints.

Regarding those of our organizations participating in bilateral cooperation, one may mention as an example the Presov Metallurgical Research Institute (VUKOV), which is designing a robotized work station on the basis of a Czechoslovak PR 32 E robot. The work station is being designed in cooperation with the GDR, and it is expected that its practical application will be in the GDR, and that it will be on display at the Leipzig Fair in 1983.

[Question] Within the framework of multilateral and bilateral cooperation, it would clearly be desirable to produce this developed welding equipment rapidly and get it on the market before it becomes obsolete.... This should, finally, also be true for future experiments with the closed cycle "from research to production."

[Answer] It is now a specific concern of ours that precisely the implementation of the results of scientific-technical cooperation in production on an international level is not a completely resolved issue. In an attempt to support the implementation in production of the findings of the scientific-technical cooperation of the CEMA countries we are organizing, in conjunction with foreign trade organizations, a regular, biannual, specialized exhibition to be called WELDING SVARKA. Research institutes will participate in the exhibition with their prototypes, and we have been successful in assuring an individual booth for the "products" of multilateral cooperation.

9276
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BULGARIA

LASER USED IN OPTICAL INDUSTRY

Sofia OTECHESTVEN FRONT in Bulgarian 18 Dec 81 p 2

[Article by Zakhari Nikolov: "Laser Beam Instead of Diamond...."]

[Text] The brilliant dot of the laser beam can be seen in the center of the small monitoring screen. The operator presses a button on the electronic system and the image on the screen begins to move. The tail of the beam slowly brings up a complex figure. This movement has been recorded and preprogrammed in the memory of the microprofessor system. This is precisely what controls automatically the new equipment for the drawing of optical scales.

What are these scales and where are they applied? Very small and fine lenses, glasses and selesium bases are used in the modern electronic and optical industries in making integral circuits. According to their purpose, they must be designed and corrected on photographic templates for semiconductor elements. So far, this delicate operation was performed with special diamond cutters. However, since they move on thin surfaces, they wear out very rapidly. The lines change their thickness and depth, which affects the quality of the optical or electronic instrument. This frequently results in the production of defective goods, replacement of expensive diamond cutters and production delays.

It is at this point that the laser beam comes to the aid of the specialists. It offers extensive possibilities of cutting and piercing all kinds of materials. Its parameters are governed by an electric system. That is why, the designers at the Optics Institute in Sofia, headed by Engineer Nedyalko Vasilev, undertook to reorganize the technology for processing optical scales and hybrid integral systems through the development of new laser equipment. What kind of equipment is this? A system of lenses focuses the laser beam on a mobile metal base on which the optical element is affixed. With the help of a control panel, the operator encodes in the memory of the microprocessor all the movements which the base must perform while the laser beam remains stable. In order for the operator to control the drawing of the optical scale, a special microscope equipped with a television camera shows on the monitor screen an image with a magnification of a factor of 20. The new technology almost doubles productivity and reduces the possibility of manufacturing defective items by about 40 percent.

This laser equipment was exhibited for the first time at this year's Plovdiv Fair and justifiably triggered the interest of all specialists in our electronic and optical industries. Such systems are found in and are manufactured by the developed countries. However, they cost more than $200,000. The designers at the Optics Institute in Sofia are using a Bulgarian microprocessor with a coordinated logical system, which can control two such laser systems simultaneously. This makes the processing of 800 hybrid systems per day possible.

Where can such equipment be applied? The first requests have already been filed by the Voroshilov Plant in Sofia and some other Bulgarian optical and electronic industry enterprises. Production will be started at the beginning of 1983. This will yield considerable foreign currency income as well, for specialists from many countries are greatly interested in the system.

5003
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CZECHOSLOVAKIA

POSSIBLE ENERGY SAVINGS IN AGRICULTURE ASSESSED

Prague KONTROLA in Czech No 12 Dec 81 pp 7-11

[Article by Eng Jan Koncel, CSR People's Control Committee: "Possibilities of Fuel, Motor Fuel and Energy Savings in Agriculture"]

[Text] There is no doubt about the urgent need of energy savings. This demand was quite frankly voiced already at the 11th Plenum of the CPCZ Central Committee in March 1978 which stated: "It is absolutely imperative to substantially and rapidly reduce the energy and raw- and industrial-materials requirements of the production sector. Their consumption per unit of production is excessively high."

Due to production concentration and specialization, fuels and energy consumption in agriculture substantially increased--almost doubled--in the last 10 years. This trend will obviously continue also in the future because the reduction of the labor force in agriculture has been considerable and cannot be made up for in any other way but through mechanization. For example, the reduction of the labor force by one production worker in animal production requires an additional investment of Kcs 500,000 to 1 million. This sum replacing materialized labor must be invested in technical equipment of the plant, including the basic part of energy already embodied in technical equipment and also of energy necessary for operation of machinery and equipment replacing production workers. On the other hand, every additional investment in agriculture, including energy, is favorably reflected in the increase in gross agricultural production. This is borne out by the calculations of the Agricultural Technology Research Institute in Prague. While a 1 percent increase in gross agricultural production required a 2.20 percent in energy increase during the 1970-1975 period, it required only a 1.63 percent energy increase in the following 5 years. This declining trend may be expected also during the present five-year plan.

Share of Agriculture in Fuel and Energy Consumption in the National Economy According to the data of the State Power Inspectorate, agriculture (excluding the food industry) accounted for 5.6 percent of the final fuel and energy consumption or 3.5 million tons of standard fuel [tmp] in 1980. In this consumption, diesel fuel and heating oil accounted for 69.5 percent, solid fuels for 17 percent, electric energy for 10 percent and heating gas for 3.5 percent. Approximately 45 percent of the total consumption volume is used for power-generating purposes and 55 percent for transportation by motor vehicles and operation of mobile equipment.

In making decisions on the solution of the complex of problems in the area of administration of fuel and energy supply, two additional fundamental factors must be realized. In the first place that agriculture uses most energy inputs indirectly in the form of mechanization devices primarily from the standpoint of their efficiency (in other words, agriculture employs equipment which it receives from the engineering sector). Other items consuming a great deal of energy are the production of chemical fertilizers and preparations and operation of irrigation facilities and drying plants which again agricultural will not affects in terms of production. Secondly it must be realized that agriculture is a sector which not only consumes, but also produces and multiplies energy by photosynthesis. (It is estimated that the energy acquired by photosynthesis is approximately 100 times greater than the energy released by the burning of solid fuels in the entire world during the same period.) The annual coefficient of utilization of energy radiated by photosynthesis is approximately 0.2 percent and does not exceed 5 percent in agricultural enterprises.

This brief analysis points to the possible or necessary orientation of the effort of all agricultural workers to the utilization of existing reserves in fuels and energy savings. These facts practically led to the formulation of the special state target program of rationalization of fuel and energy consumption and use in agriculture and food industry for the period of the Seventh Five-Year Plan which instructs the CSR Ministry of Agriculture and Food to save, in comparison with 1980, 265,000 tmp in 1985. It must be emphasized that this represents absolute savings which means that these savings must be achieved despite the anticipated increase in agricultural production.

These basic aspects must motivate, in a differentiated way, the measures aimed at fuel and energy savings--both the measures which will take effect almost immediately and future measures which basic agricultural production cannot, of course, enact alone.

Specific Economy Measures

As practice primarily in the food industry and basic agricultural production proves, the essence of both already achieved and anticipated savings lies in more intensive management and organization by all management personnel, in their orientation to potential savings, in the development of socialist competition for savings, in the establishment of positions of power engineers both at the middle levels of management and directly in the production sphere who will be responsible for rational utilization of fuel and energy, in linking bonuses to fuel and energy savings, and so on.

The state program of rationalization of fuel and energy consumption sets the tasks in fuel and energy savings for food industry which fulfilled the plan of savings 116 percent in 1980.

The summary of planned and actually achieved savings in tmp by sectors of food industry gives the following picture:

	Plan tmp	Actual tmp	%
Milk industry	6,548	7,498	114.5
Poultry industry	2,224	2,880	129.5
Meat industry	6,389	6,952	108.8
Fats industry	4,995	4,723	94.6
Sugar refineries	13,050	14,062	107.8
Canneries & distilleries	4,305	5,943	138.0
Breweries & malt plants	6,855	9,161	133.6
Flour mills & bakeries	1,206	1,439	119.3
Freezing plants	700	792	113.1
Starch plants	797	951	119.3
Tobacco industry	272	295	108.5
Chocolate factories	1,184	1,467	124.7
Mechanized packaging	581	711	122.4
Food industry, total	49,106	56,874	116.0

Apart from the MZVz CSR [CSR Ministry of Agriculture and Food], it also sets a specific task for the Agricultural Supplies and Purchase [ZZN] VHJ [economic production unit]. Savings were set at 3,399 tmp for the ZZN in 1980 and it was fulfilled 102.7 percent.

These ultimate relative annual savings were achieved primarily by small rationalization projects--as anticipated also by the Seventh Five-Year Plan--which entailed and will continue to entail general overhauls of heating equipment, reconstruction and insulation of heat distribution systems, compensation of reactive energy, insulation of water heaters, nighttime operation of certain equipment, modernization of power-consuming equipment in production technology, utilization of condenser waste heat and so on.

A somewhat more complicated situation exists in agriculture itself. Here, too, the organizational effort of management personnel focuses on the implementation of small rationalization measures, utilization of nonconventional sources of energy and innovation of hot-air drying plants (with recirculation equipment), but mainly and primarily on the fuel savings in transportation and agricultural field work.

Diesel Fuel in Transportation Is the Key

According to the findings of the Research Institute of Agricultural and Food Economics, almost 75 tons of various materials (fodder, bedding, crops, fertilizers and so on) are transported in agriculture per hectare of land annually. Thus agriculture is the biggest carrier in the state because more than 520 million tons of various materials are transported and handled in different ways annually. All other transportation in the country, that is, railroads and truck transportation, carries only little more, approximately 600 million tons. It is necessary to haul more than 50 million tons of roughage to the cowsheds for milk cows alone. Approximately 60 percent of agricultural workers' total working time is spent on transportation and handling, and the total transportation costs on the average exceed Kcs 2,500 per hectare of land.

These and other figures demonstrate the scope of transportation within an enterprise. In addition, the enterprise provides for the supplier-customer and processing organizations transportation which, due to the seasonal nature of production, is not and cannot be evenly carried out throughout the year. (More than 40 percent of materials are transported during the main harvest season in the third quarter of the year.)

The impossibility of even use of transportation vehicles during the entire year is further compounded by the uneven weight per volume of transported materials. This frequently results in nonutilization of carrying capacity of transportation vehicles with reference to the volume of transported materials.

The indisputable factor which profoundly affects total diesel fuel consumption in the transportation of agricultural materials is the fleet of vehicles which are available to the agricultural enterprise at the present time. It consists of tractors with four-wheel and two-wheel trailers, and mostly of trucks discarded by other sectors of the national economy. More than half of the total number of 101,465 tractors and 25,885 trucks used by the CSR agricultural enterprises at the end of 1980 exceeded their planned service life. This necessitated more frequent expensive repairs and maintenance. The average installed output of tractors amounted to 61.3 kWh. At the present time, agriculture receives mostly two types of tractors: Z 6911 with a 47.5 kW output and Z 8011 with a 58 kW output and relatively big diesel fuel consumption (260 grams of diesel fuel per kW an hour). Appropriate, but substantially more economical types of vehicles for transportation of light-weight materials within the enterprise, such as hauling of fodder to the barns, are simply not available.

Apart from the generally known problems of adequate quantity, appropriate structure and assortment, breakdowns, repairs of agricultural transportation vehicles (agricultural practice does not affect this), agricultural enterprises can and must radically improve the condition of internal transportation routes. It is a fact that (due to the already mentioned concentration and specialization process, and exclusion of tractors from using the highways in the first category) transportation distances have increased, but the condition of agricultural roads is very bad. It is estimated that of the total length of more than 40,000 kilometers of agricultural roads less than 2,000 kilometers are good enough for heavy loads carried by trucks.

Drying of Fodder

The second group of problems in which radical possibilities exist for achieving fuel and energy savings concerns the drying process. This involves the production of dried bulk fodder which requires a great deal of power. According to the findings of Agroprojekt, a middle-sized drying plant with an annual capacity of 512 tons of dried fodder consumes more than 408,000 kW of electric energy and 600,000 cubic meters of natural gas. The big power consumption is clear from the fact that electric and heat energy alone costs more than Kcs 47 per 100 kilograms of dried fodder. These costs not only are on the margin of economic feasibility, but--and this is essential--the necessary fuel and energy supply may actually not be available. At the present time and under the present conditions, their supply may be expected to be reduced.

These are the two basic points on which everyday attention of all management personnel in agriculture must be focused when they implement the economy measures in regard to fuel and energy. They cannot expect additional supply and must implement the adopted measures immediately.

In transportation, this is primarily the matter of organization by the management personnel (elimination of trips by empty vehicles, machinery properly adjusted to conform to the consumption norms and so on). The economics of dried fodder must dominate the drying process, that is, only the agricultural products of highest quality should be dried. The drying process cannot, of course, be eliminated from agricultural production because this would have an adverse effect and result in bigger losses.

Measures Designed to Immediately Reduce Fuels and Energy Consumption

There is not one branch of the agricultural sector--the entire food industry, crop production, animal production, auxiliary and subsidiary production--in which fuel and energy savings could not be achieved. The management sphere has already published more than enough organizational measures, guidelines, orders, recommendations and instructions for the solution of problems faced by the production enterprises. Moreover, briefing conferences, seminars, working meetings are organized at various levels every year to exchange views and experiences with economy measures and fuel and energy savings. The prospective energy experts are trained in special courses in which existing technical and organizational shortcomings are pointed out.

It is, therefore, the foremost and most urgent task at the present time to intensify control by management personnel over the implementation of all economy measures in the production sphere because it is precisely there that most savings must be achieved. It is imperative, however, to provide in advance for additional potential savings even in the preproduction stage, that is, development, research, design of machinery, design of construction projects and so on. This desirable advance planning must be backed up by the necessary economic tools such as prices, grants, subsidies and so on for agricultural supplies such as industrial fertilizers, chemical preparations and the like.

Middle Level of Management

Control by the middle levels of management (VHJ, KZS [kraj agricultural administrations], OZS [okres agricultural administrations]) must, therefore, focus on the implementation of tasks assigned to them by the center, their elaboration within every enterprise's jurisdiction and creation of conditions for the required production results. In particular, they must check:

1. Whether the study of the problems pertaining to the rationalization of fuels and energy consumption and potential savings have become an integral part of the work of management personnel and of management conferences. What use is made by management of improvement proposals and inventions, comments and suggestions for fuels and energy savings which are submitted by the subordinate units. How are the good results achieved communicated to other enterprises and plants and applied by them;

2. How are the power departments manned with cadres and personnel and whether the relations of superiority and subordination as well as individual responsibilities are clearly defined. How, to what extent and in what respect these departments cooperate with the power engineers of enterprises and plants. To what extent they are financially dependent on the savings achieved (target premiums, special bonuses);

3. They must determine the documents by which the tasks have been assigned to VHJ, KZS and OZS for implementation of the state program, and what the management has done administratively, but mainly organizationally, for their implementation;

4. To verify the content and depth of the analysis of energy management. Especially, whether savings have been computed in comparison with the plan and additional measures have been taken to save fuels, by individual types, and electric energy during the subsequent period (not exceeding the five-year plan);

5. To verify the implementation of economy measures in 1980 and the first half of 1981, and the implementation of the state program. If the anticipated effect was not achieved, it must be stated by how much it fell short of the goal and why;

6. Whether during the practical application of economy measures, the changes in the conditions which were to be brought about by these economy measures have not already occurred;

7. Whether the anticipated results have been practically checked, that is, whether warranty, operational and other tests were carried out in the newly started capital investment projects, but also in connection with minor economy measures, and what results were achieved;

8. How control over the observance of technically justified norms of fuel and energy consumption, particularly in fodder-drying plants and transportation, is carried out. How frequently and on what basis the consumption norms are revised to make them increasingly more strict. If the norms are set by the management itself, to determine the manner in which they were formulated and how they were subsequently utilized for management of the production process;

9. Whether the stricter norms for fuel and energy consumption have not led to omitting some operations to the detriment of quality.

Production Enterprises and Plants

Control in the production plants and enterprises must focus on the actual savings achieved prior to the organizational measures providing for their achievement (although this aspect cannot be ignored in the enterprise-workplace relationship). Moreover, the same procedure should be followed in checking on the enterprises which have achieved the anticipated savings because there still may be some hidden hitherto unplanned or not yet mobilized reserves, or the savings achieved by them may be underrated.

Enterprises of an industrial nature, that is the entire food industry, some agricultural services, STS [State Tractor Stations] and OZS and so on, but also some agricultural operations will be audited from the following criteria:

1. Whether rational management of fuel and energy supply and their potential savings have become an integral part of the work of all management personnel. How frequently, with what conclusions and how they are implemented. Whether the plant management explores the possibilities of savings. Whether energy commissions have been established at the enterprise and plant management and how they cooperate with the development and research centers which should set up consultant centers and offer advice;

2. How the positions of power experts are filled in plants and enterprises. Moreover, whether these positions are not cumulative;

3. To verify the scope, depth and standard of analyses of power engineering in enterprises and plants. Whether the analyses result in specific and controllable conclusions with personal responsibility precisely defined and deadlines firmly set. Whether the planned savings and preventable losses have been listed for individual types of fuel and energy for the following year (not going beyond the current five-year plan);

4. Whether the production enterprises have revised consumption diagrams on the basis of anticipated savings, and whether these savings are reflected in consumption standards or consumption norms;

5. Whether the consumption diagrams are adhered to;

6. The basis of what, on the basis of which norms and what method is used in calculating savings in fuel and energy. (Accuracy and reliability of measuring and regulatory devices used.)

In the area of agricultural production specifically, the appropriate control organs, that is, auditing commissions of JZD [unified agricultural cooperatives] and auditors of state farms should focus their attention on the elimination of obvious energy losses through the inspection of appliances and equipment, and on the energy losses caused by inadequate work organization and management, and inadequate attention to and maintenance of equipment. In particular the following points should be checked:

1. How is the organization and technology of agricultural transportation optimized. What possibilities do the enterprises possess for switching the bulk of transportation volume from tractors to trucks. How are the norms of diesel fuel consumption observed. Whether in case of excessive consumption, tractors and trucks are sent to shops for repairs and adjustment of consumption. Whether consumption is checked by periodical tests revealing the number of liters of diesel fuel consumed. To express in figures to what extent potential total consumption above the norm is justified by performance of more work. Whether the ban is observed on parking of tractors in the place of the driver's residence. Whether diesel fuel is issued to drivers against their signature and whether its consumption by individual drivers is periodically reviewed. What conclusions are drawn from this evaluation. Whether electric starters of tractor and truck engines are properly maintained in order to eliminate idle runs.

2. How are the principles issued by the CSR MZVa for operation of drying plants particularly observed in the following respects:

a) whether the operators of drying plants are professionally qualified and follow the optimal technological procedures in drying:

--as to the correct selection of quality products for drying (observance of the ban on drying of agricultural products with a high water content such as pulp from sugar refineries, or a high excrement content and so on);

--as to the drying of withered fodder with the lowest possible moisture (according to the findings of UVSH [Institute for Scientific System of Management], the dried fodder increase from 18 to 30 percent results in 41 percent savings or 140-145 kg of BS 18 light heating oil per ton of dried fodder);

--as to the observance of prescribed input temperature at 800-900 degrees Celsius and output temperature at 110 degrees Celsius;

--as to the optimization of moisture of finished dried fodder to approximately 12 percent;

--as to the proper maintenance, frequency of controls and extra thorough checks on the technical condition of drying plants;

--as to the correct functioning of measuring and regulatory devices;

--as to the causes of differences in fuel consumption in comparison with the plan;

b) whether the plan technically provides for recirculation of the heat medium into the drying process.

3. Whether electric energy is economically used particularly in the buildings used in animal production, stationary production lines and warehouses. To compare the results achieved by the centers of identical or similar types, for example in regard to:

--lighting (cleanness of lighting fixtures, windows, skylights, replacement of electric bulbs by more economical lighting, automatic regulation of lighting, regulation of lighting by stages to the feasible margin of safety not only in barns, but also in outside lighting, introduction of sodium or halogen discharge tubes, elimination of errors in installation, checking on the implementation of tasks in firefighting and safety equipment);

--ventilation (what are the possibilities of natural ventilation and how effectively is it used instead of forced ventilation; possibilities of semiautomatic regulation of ventilation; whether ventilators are properly maintained; protection of electromotors from the effect of the barn environment) and prevention of its reduced efficiency;

--heating (whether changes have been made in the buildings for protection against severe winter weather--installation of additional doors, double-pane windows, air screens; checks should focus on the technical condition of heat sources; to compare warranty tests and results of heating tests with the operating values; observance of consumption limits for individual boilers as well; frequency of service for adjustment of burners; checking on the insulation of heat-distribution systems, tightness and functioning of caps on safety and control valves; whether the plan of replacement and modernization of heating appliances has been developed and is observed);

--production technology. In animal production, fuel and energy production technology largely consists of combined consumption of electric energy (milking and milk care) and diesel fuel (transportation of fodder). Energy can be replaced in handling of fodder and removal of manure and bedding. To check whether all energy-consuming equipment is properly maintained and whether unnecessary idle runs do not occur. Whether smaller tractors are used for hauling of fodder. Whether in the sheds for calves and chickens infraradiators [illegible] replaced by heat sources not requiring so much energy (floor panels) and so on;

--heating of utility water (whether water heaters are properly insulated and use is made of nighttime current; whether unconventional sources, such as solar energy or waste heat produced by milk cooling are or will be used for heating of utility water).

In crop production the control organs must focus their attention particularly on:

--the work organization of driving units of machinery in the production processes in order to prevent their unnecessary movements in the field and idle runs;

--whether implements with disks are primarily used in the cultivation of soil.

Long-Term Measures

Economy measures must be devised particularly for energy consumption in agriculture and the verified results must be applied practically on the largest possible scale. For this reason, management personnel at the middle level of management and managers of enterprises and plants should be made responsible for their implementation. This will particularly involve the verification of past practices and of the degree of application of well-known results not only as to the larger use of nonconventional sources of energy (solar energy, utilization of waste heat produced by milk cooling, utilization of biogas, recirculation of hot air, waste heat of compressor stations on the transit gas pipeline), but also a changed attitude by management personnel toward the solution of fuel and energy problems from the standpoint of elimination of unnecessary losses.

Elimination of Losses Is the Basis

The elimination of agricultural losses is the essence of the problem, the very basis of its solution from the standpoint of future fuel and energy savings. Very approximate and tentative calculations prove that the elimination of losses will solve the fuel and energy problem in agriculture. Innumerable specific examples can be quoted to support this assumption. The Agricultural Technology Research Institute has calculated that with the maximum utilization of available harvesting equipment and a 30-50 percent increase in the basic number of machines, the losses caused by harvesting of over-age plants could be reduced (harvesting at the time of biological maturity) which would represent the value of 460 million liters of milk on 236,000 hectares alone. Another measure, the shortening of the interim period between harvesting and removal, leaching by rain and biological processes would represent 500 million liters of milk. Fertilizers were used in the production process (they consume the most energy. It is estimated for example that the production of 1 kilogram of nitrogen requires the amount of energy equivalent to the consumption of 2 liters of diesel fuel). Yet, these fertilizers were applied without a significant effect. As to animal production, Agroprojekt has calculated that electric energy consumption in the medium-size shed for 1,310 calves amounts to 470,800 kWh. This means that one calf requires 358.78 kWh. Fuel consumption is also considerable--546 tons of coal or 417 kilograms per calf and almost 34 tons of diesel fuel or 26 kilograms per calf. Despite all this, calf losses by death, miscarriage and for other reasons are not exceptional. All energy put in is thus lost, not taking into consideration energy used in production of fodder for animals.

This is general evidence that these additional investments designed to reduce the above losses are substantially lower than the investments necessary for increasing the existing production volume.

In crop production, the following issue assumes increasing importance: the elaboration of the proposal and its specific practical application for those operations which reduce the amount of work in all instances in which the indirect energy input in the form of fertilizers and protective chemical preparations does not increase to an unfeasible degree. The solution of this problem can be found, for example, in the decision as to when and under what conditions the plowless system of soil cultivation can be introduced. This is so because the work of the Crop Production Research Institute makes it clear that if the plowless system requires the application of an additional 4 liters of Gramoxon per hectare and approximately 20-30 kilograms of nitrogen, the plowless system in terms of energy consumption completely equals traditional soil cultivation. In such instances, the decision on the advantages of minimization or of the plowless system is affected by additional factors, such as yield, need of manual labor and so on. On the other hand, it is also imperative to take into consideration such factors as an increase in the humus content of the soil (by conventional plowing, plowing-in of plant remnants, the rate of air flow in it from the standpoint of the viability of microorganisms in the soil, regulation of water flow) and others. The decision on the application of the plowless system is furthermore compounded by the fact that frequent movements of mobile equipment excessively harden and devastate the soil. Research calculations again prove that every hectare of the area is crossed more than three times. This makes the workability more difficult and necessitates greater energy consumption.

There are several such and similar cases which must first be actually verified, and the solution to these problems must be found.

For this reason, the control organs must check what was organizationally done under specific conditions for utilization of all possible and feasible forms of additional fuel and energy savings, such as the application of findings of scientific research centers and models of outstanding enterprises which have already acquired some experience with the results.

--Whether the enterprise has developed the best possible transportation system, whether it is planning organizational changes in sowing procedures in order to shorten the routes for transportation of fodder to barns. The utilization of grazing, whether and to what extent the enterprise has designed a project for improving field roads; whether consumption norms are gradually made more strict; whether the hauling plans are properly prepared and coordinated with the organization of transportation between agricultural enterprises and public truck highway transportation.

--What progress has been made in centralization of transportation vehicles in the larger units with precise dispatching control in order to make effective use of vehicles moving in opposite directions; whether the obsolete trucks are gradually replaced by new ones.

--What organizational measures are planned by the enterprise to replace driers (consuming a great deal of energy) by other procedures such as active ventilation of grains and utilization of solar energy.

--Whether optimization has been achieved in the application of intensive inputs in production which indirectly save energy in the form of industrial fertilizers applied and of chemical agents which contribute to the increase in the natural fertility of the soil.

--Whether full use has been made of the possibilities already verified in agriculture such as utilization of heat produced by the cooling of milk for heating of utility water or use of waste heat from industrial enterprises for growing vegetables in hothouses and so on, utilization of animals' biological heat and biogas, but also whether the forklift trucks using diesel fuel have been replaced by trucks employing propane-butane in warehouses, and so on.

Conclusions

Rational administration of fuel and energy supply in agriculture does not consist only in "turning the switch on and off" because it involves problems which affect all sectors of production activity in agriculture. Even if every additional energy input in agriculture is very effective, ways and possibilities of savings must obviously be explored. These lie in the immediate exploitation of all possibilities (transportation and drying plants), but mainly in the reduction of losses of all kinds. This necessitates a completely new attitude by management personnel, not only in agriculture, but also in processing industries. It is quite logical that conditions must be created in agriculture for additional savings by changes in the structure of the existing machine fleet, by new capital investment, by more effective assistance by the scientific research centers, by the improvement of supplier-customer relations and so on.

10501
CSO: 2402/12

NEED FOR MICROPROCESSOR PRODUCTION EMPHASIZED

Prague SDELOVACI TECHNIKA in Czech No 12, 12 Dec 81 p 441

/Editorial by CR: "Do We Want a Microprocessor?"/

/Text/ The term "microprocessor" is probably the most frequently used word in contemporary technical practice. It has found its way even into the dictionary of politicians and economists. The concepts of it are still sometimes distorted, but people have become now generally aware that there is something here which cannot be ignored in any sphere of creative human activity. What cannot be disregarded is not the microprocessor itself, but microelectronics, which is developing at an incredible speed. Its development is accompanied by the development and production of types of integrated circuits which are bringing about a basic change of quantitative indices from the viewpoint of both manufacturers and products. Microelectronic circuits have become predominant in the nontraditional area of application and have provided an incentive for an extensive innovation of engineering products of the investment and consumer goods type. At the same time, the important thing is that the higher utility value of the new products is determined precisely by the use of integrated circuits.

It is natural that the process of microelectronization has its problems with regard to the manufacturers of integrated circuits themselves, but there will be much greater problems among the prospective users. They will have to get acquainted many times with something which will be entirely new to them. Complex integrated circuits are accompanied by descriptions of their function, which cover many pages and are not always very clear. The user will soon find out that the process of measuring the accuracy of the functioning of such a circuit in a system cannot be reduced to plugging an oscilloscope in some outlet. Electronic systems with a microprocessor can be programmed. Therefore, it will be necessary to be able to create effective programs.

We can see that it is impossible to put to use microelectronic components rapidly without extensive retraining of personnel. The interest of individuals at separate workplaces will not be enough. Instead, it is necessary to train the present circuit operators in applying new methods of drafting and designing electronic systems. If microelectronics is to find its way into electronic practice, it is necessary to convince first the management workers that the task, which is not easy, cannot be avoided, but that it can be handled.

The significance of electronics for further development of our industry, above all of our mechanical engineering, is also based on the resolution of the 16th CPCZ Congress. This obligatory project explicitly states that electronization of the national economy is a prerequisite. It assigns exceptionally important tasks to the manufacture of parts, and at the same time it expects that when integrated circuits are put to use in practice, the export capacity of our products will increase significantly. If we make a layman's confrontation of the present status in terms of the assortment of microelectronic circuits and of the number of their practical applications with the goals of the Seventh Five-Year Plan, we can easily come to the conclusion that the main job is still ahead of us.

The scope of the goals outlined to us by the 16th CPCZ Congress must also be matched by dedicated management activity of the responsible economic organs. The dedicated involvement must be reflected in a determination of demanding and, at the same time, realistic goals, accompanied by a determination of their direct practical utilization. It is necessary to keep creating a creative atmosphere in which there cannot be room for discussion as to why something cannot be done. In the given context, it is appropriate to recall the significance of various forms of incentives designed to stimulate production work. At the same time, in many cases the sincere interest of leading management workers in the work of their subordinates will produce better results than a mere written announcement of a reward for reaching the target.

The rapid entrance of electronics on the scene in all branches of our industry is possible only if schools of all types contribute effectively to it. In the process of getting broad technical circles of the public acquainted with the ways in which microelectronic circuits can be utilized, we expect a good deal of work to be done by key social organizations, such as, for example, the CSVTS /Czechoslovak Scientific-Technical Society/ or Svazarm /League for Cooperation with the Armed Forces/. Technical literature remains somewhat in the background for the time being, even though that is precisely what must play one of the key roles in the expected entrance of microelectronics on the scene. Constant propaganda and popularization must create successive pressure on all components of the economic mechanism in our republic. It would be desirable to see to it that national and professional pride be increased in an appropriate form, and that critical admiration of foreign achievements be balanced by efforts to get our technicians acquainted with successful domestic constructions.

As of 1982, complex integrated circuits will be put to use in practice in the CSSR. A typical representative of these is the 8080A microprocessor. Its expected properties will be equivalent of those of the corresponding foreign circuits. Therefore, we will also be able to use literature dealing with its function, which is really extensive. Many parts of the accompanying literature on the 8080A microprocessor have already been published in all kinds of periodicals, almanacs and also in a few books. These sources of information evaluated the microprocessor in most cases exclusively from the viewpoint of the classic user, who looks at the microprocessor as if it were a "black box." The main article contained in the present issue of the SDELOVACI TECHNIKA /Communication Engineering/ should fill a certain gap in the known pieces of information. By describing the technical means with which the 8080A microprocessor takes care of the required function, we want to bring its functioning closer to the way of thinking of contemporary designers of electronic systems.

In order to build prospective microprocessor systems, it is not enough to provide for the basic assortment of complex integrated systems. The corresponding requirements must be matched also by various types of connectors, multilayer surface couplings, push buttons, connecting cables, and picture-tube systems. Sensors used for measurements and conversion of physical magnitudes into electric magnitudes will be particularly important. Also, control microcomputer systems cannot be conceived without integrated analog-digital convertors.

In closing, let us return to the title of this editorial and give our answer "yes." But at the same time let us all do what is not only in our power, but also what in many cases is our duty in order to bring about a substantially faster development of Czechoslovak electronics.

5668
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USE OF YAG LASER FOR WELDING DESCRIBED

Prague JEMNA MECHANIKA A OPTIKA in Czech No 10, Oct 81 p 260

[Article by Eng Jiri Kubelka, Monokrystaly Turnov: "Application of a YAG:Nd Laser in Welding"]

> [Text] This article describes a simple pulse laser welding apparatus and the results obtained in the welding of stainless steel with it.

1. Introduction

Laser welding has a number of advantages. It is a noncontact method with high weld-positioning precision: the heat energy is liberated in a small area and during a very short time interval, so that the area affected by high temperatures is extremely small. In addition, there is practically no contamination during welding, and any type of protective atmosphere is simple to use.

Foreign sources describe a number of practical applications, particularly involving the packages of temperature-sensitive components, welding of contacts and of thermocouples, and welding of zirconium in the production of nuclear fuel elements.

Czechoslovakia has several types of laser welding devices, including the laser welders developed by Tesla VUVET [Research Institute of Vacuum Electrical Engineering] and the Soviet Kvant-12 model. Nonetheless, it is expected that there will be a shortage of equipment, even for testing this welding method in specific industrial and development applications. This article describes a simple pulse laser welding device incorporating a laser head and power supply developed by the Nuclear and Physical Engineering Faculty [FJFI] of CVUT [Czechoslovak Military Institute of Technology] in Prague.

2. Description of the Equipment

A block diagram of the device is shown in Figure 1.

The laser cavity was developed by FJFI. It is a single ellipse cavity with a close-fitting discharge tube and laser crystal. The cavity has three independent cooling loops (discharge tube, crystal, surface). The laser crystal consists of yttrium aluminum garnet (YAG) doped with neodynium produced by

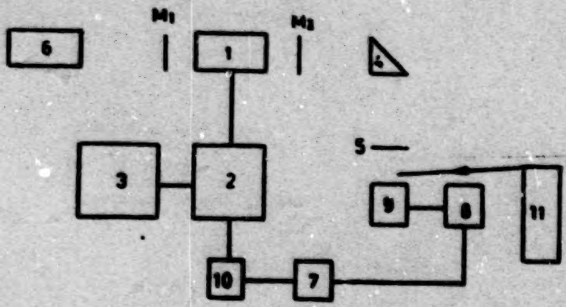

Figure 1. Block Diagram of the Equipment

Key:

1. Laser cavity
2. Laser power supply
3. Capacitor and inductor bank
4. Prism
5. Converging lens
6. He-Ne laser
7. Generator with preselector
8. Control circuits
9. Step motor
10. Repetition frequency generator
11. Argon vessel

M_1, M_2. Laser mirrors

Monokrystaly. The cavity contains a Soviet-made IFP-800 discharge tube. Mirror M_1 is a 100-percent reflective dielectric mirror and M_2 is a sapphire plate.

The laser power supply was manufactured by FJFI. It furnishes a precise voltage to the capacitors connected to it. The laser may be fired manually or automatically. The arc in the discharge tube burns continually. The power supply does not contain a heavy, bulky distribution transformer.

The capacitor and inductor bank was constructed by Monokrystaly. Connecting it to the laser power supply produces a nearly square light pulse with a duration of 4 ms in the discharge tube.

The optical system consists of a prism and a simple converging lens. Antireflective coastings were vacuum-deposited on both components at Monokrystaly.

The TKG 205 He-Ne laser is used to adjust the laser head and the piece to be welded.

Following each laser flash, the generator with preselector generates from 1 to 99 trigger pulses for the control circuits of the Z 22 QX 109 step motor (MEZ [Moravian-Silesian Electrical Appliances Plant] Nachod). This makes it possible to rotate the motor shaft through an angle of 1.5° to 148.5° in 1.5° increments after every flash. If circular welds are called for, the piece to be welded is fastened directly to the motor shaft.

The device generates 4-ms laser pulses with a maximum output energy of about 10 J. The efficiency of the gate device, i.e., the ratio of the generated laser energy to the energy accumulated in the capacitor bank, is about 1 percent. In the experiments we used 5-J laser pulses. This output energy can be generated with a repetition frequency of about 1 Hz.

3. Practical Results

The welding tests were conducted on samples of AKVS stainless steel (CSN [Czechoslovak State Standard] 17 246). The test pieces had the shape shown in Figure 2. The task was to weld a circular disk to the body of the test piece.

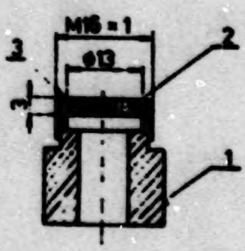

Figure 2. Weldment

Key: 1. Body of test piece 2. Circular disk 3. Laser weld

The test pieces were welded, using the equipment described, at an output energy of 5 J. The step motor shaft was rotated through 3° after each laser pulse, so that a total of 120 pulses were applied to the circumference of the disk. The weld was blown with argon from the side.

The final weld was made by overlapping the individual spot welds, which had a diameter of about 0.8 mm. The depth of the melted area was approximately 1 mm. The strength and tightness of the welds was measured. The strength was measured by using a mandrel to press the disk out of the test piece. A force of 21,600 N was required, i.e., 5,260 N per centimeter of weld length. Tightness was measured with a 112 VW helical leak detector produced by Tesla Elstroj [Electrical Machinery]. After welding, leaks were detected in an average of two to three locations. Further rewelding thoroughly eliminated these leaks.

4. Conclusion

The equipment described is usable for laser welding. Use in industry obviously would require a higher repetition frequency in most cases; in the present case it was limited primarily by the power supply used, which was intended for a different application. A higher-power power supply and a larger cooling system should result in a repetition frequency at least 10 times as great.

8480
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CZECHOSLOVAKIA

BRIEFS

VITAMIN C DISCOVERY--Even though 170,000 improvement suggestions are accepted and 6,000 inventions patented in the CSSR annually, only 22 diplomas for discoveries have been awarded since 1975. On 21 January 1982, 4 additional diplomas were presented. One of the recipients was Dr Emil Ginter, CSc, of the Research Institute of Nation's Nutrition (Vyzkumny ustav vyzivy l'udu) in Bratislava. According to Dr Ginter, his discovery came to light during basic research done within the state plan of the Slovak Ministry of Health. Dr Ginter discovered that vitamin C is necessary for physiological process of oxidation and removal of cholesterol from liver. Due to a hidden insufficiency of vitamin C in body, primarily during the winter and spring, removal of cholesterol is hindered and it begins accumulating on vascular walls. On the contrary, when organism receives an optimal dosis of vitamin C (natural or synthetic), liver has an increased capability to eliminate cholesterol and reduce the possibility of transformation of a healthy vascular system into a diseased one. Dr Ginter's discovery, which has been scientifically attested and proven, explains and emphasizes the importance of fruits and vegetables in nutrition. [Prague MLADA FRONTA in Czech 22 Jan 82 p 2]

WASTE TIRES SAVE FUEL--A project sponsored by concern Cement and Lime Works (CEVA) in Prague to reduce fuel consumption by burning discarded tires in rotary cement kilns has been implemented at cement works in Mokra near Brno. The project has reduced natural gas consumption at the works 10 percent. Saving 700 cubic meters of natural gas per hour, this represents annual amount of gas used by one household. Moreover, steel belts from the tires have a positive effect on the quality of cement. [Prague SVOBODNE SLOVO in Czech 28 Jan 82 p 2]

FERTILIZER IMPORTS FROM USSR--Daily, about 2,310 tons of chemical fertilizers arrive in the CSSR from the USSR through Soviet foreign enterprise Soyuzpromeksport in form of superphosphate, ammonium sulphate, ammonium nitrate, ammonium phosphate, potash salt and urea. Soyuzpromeksport also delivers large quantities of apatite which is processed in the CSSR by chemical plants Chemko in Strazske, Duslo Sala, Jiri Dimitrov Chemical Works in Bratislava and Prerov Chemical Works. Total CSSR chemical fertilizer imports from the USSR reached 800,104 tons in 1981, exceeded by 3,081 tons, bringing the 1981 imports total to 53,081 tons. [Prague RUDE PRAVO in Czech 18 Jan 82 p 2]

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